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APR 15 1918

UNITED STATES DEPARTMENT OF AGRICULTURE
SYLLABUS 31

Contribution from the States Relations Service
A. C. TRUE, Director
In Cooperation with the Bureau of Plant Industry
W. A. TAYLOR, Chief

Washington, D. C.



March 15, 1918

ILLUSTRATED LECTURE
ON RENOVATING THE NEGLECTED
APPLE ORCHARD

By

H. M. CONOLLY, Assistant Horticulturist in Agricultural
Education, States Relations Service

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

U. S. DEPARTMENT OF AGRICULTURE,

STATES RELATIONS SERVICE.

A. C. TRUE, Director.

In cooperation with the Bureau of Plant Industry, W. A. Taylor, Chief.

SYLLABUS 31—ILLUSTRATED LECTURE ON RENOVATING THE NEGLECTED APPLE ORCHARD.¹

By H. M. CONOLLY, *Assistant Horticulturist in Agricultural Education, States Relations Service.*

INTRODUCTION.

View.

In a great many sections of the United States there are large numbers of neglected farm apple orchards. These farm orchards vary in size from a few trees to several acres. Many of them were planted to supply fruit for home use and not intended as commercial orchards.

The people who planted these farm orchards knew little about orchard management. The orchards not being a source of income were left to take care of themselves. The trees were often planted on the poorest soil and in the most unsuitable location on the farm. Wherever the conditions were favorable good trees have been produced, but under unfavorable conditions the trees have become stunted, scrubby, or diseased. In most cases the trees were set very close together and as they grew the lower limbs died off or were cut because they interfered with operations that should not have been permitted in an orchard. This cutting left only the high growing limbs to bear the fruit. All the pruning that was done usually consisted in the cutting off of all the lower limbs. These old farm orchards usually stood in sod, the hay being cut or else pastured off. In many cases the orchards were planted to the regular farm crops. Through neglect or improper management nearly all of these farm orchards have become diseased and worthless. The trees

¹ This syllabus has been prepared by cooperation between the Division of Horticultural and Pomological Investigations of the Bureau of Plant Industry, as regards subject matter, and J. M. Stedman, Farmers' Institute Specialist of the States Relations Service, as regards pedagogical form. It is designed to aid farmers' institute and other extension lecturers in presenting the subject before popular audiences. The lecture is an adaptation of Farmers' Bulletin 491, *The Profitable Management of the Small Apple Orchard on the General Farm*, by M. C. Burritt, with the additions and changes needed to fit it for the special purpose it is to serve. The syllabus is illustrated with 50 lantern slides. The numbers in the margins of the pages refer to the lantern slides as listed in the Appendix.

View.

produce little or no fruit, and if any is produced it is very inferior in quality. In many cases the old trees have also become very unsightly.

NEED FOR ORCHARD RENOVATION.

The population of the country has been rapidly increasing and better methods of handling and distribution have all been factors in increasing the demand for fruit. Thousands of acres of commercial orchards are being planted in many sections of the United States to supply this demand for fruit. A great number of small home orchards have also been planted by the farmers to supply their own families with fruit. The old farm orchards can often be renewed so that they will produce sufficient fruit for home needs as well as some for market, until the younger orchards become productive.

Although the old farm orchard was not planted with the idea of its producing any income, still if it occupies any considerable amount of space it should be made to produce an income or else be taken out to make room for the production of other crops. The ideas of diversification should include the orchard, and whether there are 10 trees or 50, they should be made to produce their share of the farm income.

IS THE ORCHARD WORTH RENOVATING?

This question should be settled in regard to every orchard before any of the work of renovation begins. A careful survey of the orchard should be made and the information set down on paper. It is a good plan to mark on the paper the location of every tree, the variety, and the approximate condition. Also show on the paper the places where trees are missing. The information collected in this inventory will help one in deciding whether the renovation work can be profitably done or whether it would be better to cut out all the trees and use the land for other purposes. If renovation work is done without making an inventory it often happens that there are a fewer number of good trees left than it was at first supposed.

Orchards that it probably will not pay to renovate may be grouped into four classes:

(1) Orchards with less than 50 per cent of a stand of trees, especially when they are more than 40 years of age.

(2) Orchards with poor or undesirable varieties.

(3) Orchards on a poor or unsuitable soil or in an unfavorable site or location.

(4) Orchards in which the trees are badly diseased and show very few signs of vigor.

When the trees in an orchard do not occupy more than 50 per cent of the land it usually will not pay to cultivate all the land for these few unless the 50 per cent be very regularly distributed over the land. It is not as a rule advisable to fill in an old orchard with younger trees. Sometimes, however, this may be done if trees are not too old and where rapid-growing and early bearing trees, such as Wealthy, Oldenburg (Duchess of Oldenburg), Yellow Transparent, and Wagener, are used. When trees are older than 35 to 40 years the chances of successful renovation are very much less. Older trees should be in exceptionally good condition if renovation is to be attempted, as it is much more difficult to infuse vigor into old trees than into younger ones.

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POOR VARIETIES.

It usually will not pay to renovate orchards composed largely of worthless or very poor varieties. Nothing is to be gained by increasing the yield or grade of a variety which can not readily be sold in the open market at a good price. When trees of such varieties, however, are not too old—not more than 30 years—and are in fairly good vigor, they often may be top-worked to advantage.

There is some question as to whether it will pay to renovate summer apples in the Northern States. To make renovation of these trees profitable requires either a good demand in the local market or exceptionally good transportation to and demand in a more distant market. Much the same is true of odd or uncommon varieties.

Some of the characteristics which make a variety poor are unattractiveness in shape, size, or color; inferior dessert quality; lack of hardiness in tree or fruit, making them subject to disease; small production; and being comparatively unknown in the market and therefore not in demand. To make a variety worth renovating, then, it should be fair to good in dessert or culinary quality; attractive; a fair or, better, a prolific producer; a good keeper and shipper; and in good demand at good prices in the market. All these factors should be considered before renovation is attempted.

UNFAVORABLE CONDITIONS.

An apple orchard set on a wet soil which can not be readily drained is worthless. Trees set on poor soils require too much fertilization to get them in shape to allow of much profit. Trees growing on soils that are too dry or leachy are less amen-

View.

14 able to renovation. In like manner orchards located in frost pockets, at elevations too low or too high, on sites too much exposed, or on slopes too warm or too cold will not pay returns on the money spent in renovating them equal to the returns from those better situated. The renovation of orchards at a considerable distance from the railroad, with poor highways and poor shipping facilities, and in isolated and inaccessible places will not prove as profitable as the renovation of orchards in better locations. In short, orchards on sites or locations which are naturally unfavorable to apple growing will be more expensive to renovate and less profitable in the end, and, in fact, may not give any profitable returns because of these adverse conditions.

BADLY DISEASED TREES.

15 It costs considerably more to renovate a badly diseased
16 orchard than one not so diseased. Dead branches and limbs
17 must be removed and the effect may be to seriously and permanently weaken the tree. Disease frequently stunts the growth to such an extent as to make it impossible to rejuvenate the tree. If vitality has been lost, no amount of stimulation will restore it. Good vigor, even though it be dormant, is absolutely essential in a tree if it is to be improved. Trees which have been weakened by San Jose scale, or frequently defoliated by cankerworms, or in which apple-tree canker and bitter rot have obtained a strong foothold are expensive to rejuvenate and unsatisfactory when rejuvenated.

CAN NEGLECTED ORCHARDS BE MADE PRODUCTIVE BY RENOVATION?

This question can be partially answered by data gathered in western New York by the New York College of Agriculture at Cornell University. These data were collected in surveys made in several of the leading apple-producing counties of the State and included a study of 11,000 acres of orchards. These orchards were in a sense renovated, but they had never been as badly neglected as in many other sections of the East. The greater part of the trees were 30 to 40 years old. The figures show the possibilities which may be secured under the best methods of culture, but are probably better than what may be expected of the general-farm orchard. Tables I and II are compiled from the above data:

TABLE I.—*Number of orchards and acres surveyed in 4 counties in western New York from 1900 to 1908, with average yields.¹*

County and year.	Number of orchards.	Area surveyed.	Average yield per acre.	County and year.	Number of orchards.	Area surveyed.	Average yield per acre.
Wayne County:		<i>Acres.</i>	<i>Bushels.</i>	Niagara County:		<i>Acres.</i>	<i>Bushels.</i>
1900.....	189	1,687	229	1902.....	125	1,415	236
1901.....	318	2,282	32	1903.....	273	2,736	197
1902.....	416	3,037	203	1904.....	459	4,321	195
1903.....	200	1,621	235	1905.....	372	4,152	155
				1906.....	173	2,031	179
4-year average.	281	1,914	183	5-year average.	280	2,931	192
Orleans County:				Monroe County:			
1900.....	176	1,581	241	1905.....			189
1901.....	212	1,972	63	1906.....			223
1902.....	356	3,195	248	1907.....			166
1903.....	485	4,345	224	1908.....			199
1904.....	283	2,869	234				
5-year average.	302	2,792	212	4-year average.	336	3,675	194

¹ From the orchard surveys of Wayne, Orleans, and Niagara Counties, Bulletins 226, 229, and 262, respectively, Cornell University Agricultural Experiment Station. Monroe County survey not published.

TABLE II.—*Average yield in bushels per tree in 3 counties of western New York from 1900 to 1906. Trees mostly 30 to 45 years old.¹*

County.	Year.							Average yield.
	1900	1901	1902	1903	1904	1905	1906	
Wayne.....	5.8	0.8	5.0					3.3
Orleans.....	5.8	1.5	6.0	5.4	6.8			4.6
Niagara.....			6.6	5.0	4.7	4.6	4.4	4.8

¹ From the orchard surveys of Wayne, Orleans, and Niagara Counties, Bulletins 225, 229, 262, respectively, Cornell University Agricultural Experiment Station.

The answer is plain, but must be qualified. In most cases it probably will pay to renovate the old farm orchard. In some cases it will not pay.

COST OF RENOVATION.

The cost of renovation will be considerable, but if the trees are worth renovating the returns will warrant the expenditure. The estimates shown in Table III have been carefully made from records obtained on several farms in New York State by the Office of Farm Management, United States Department of Agriculture. The figures show the probable minimum and maximum cost per acre for the first year.

View.

TABLE III.—*Estimated cost of first year's work in renovating an old orchard.*

Item.	Estimated cost per acre.	
	Minimum.	Maximum.
Plowing.....	\$2.00	\$3.00
Manure, 10 to 20 loads, at \$1, or its equivalent in commercial fertilizer.....	10.00	20.00
Hauling manure, average, at 50 cents per load.....	5.00	10.00
Pruning and hauling brush.....	5.00	10.00
Disking or harrowing twice.....	1.00	1.50
Disking or harrowing third or fourth time.....	.50	1.00
Cultivation, two to four times.....	.50	1.00
Spraying once:		
Material.....	2.00	4.00
Labor.....	1.00	1.50
Total.....	27.00	52.00

For each additional spraying after the third the cost should be increased correspondingly; that is, \$1.50 to \$2.50 per acre should be added.

It will thus be seen that the probable cost of the first year's work will be from \$30 to \$57 per acre, according to circumstances. On account of the shock to the tree of sudden change of treatment and because of the insufficient time for its good effects, the income the first year will probably be very small and possibly nothing at all. After the first year, however, the income should increase each year to its maximum as the good effects of the treatment are obtained. It is, of course, evident that the cost and profit will vary with the thoroughness of the treatment, the number of trees per acre, and similar variant factors.

HOW TO RENOVATE AN ORCHARD.

Four important steps must be taken in the improvement of the neglected orchard. These steps are practically the same as those which would be employed in the average orchard under normal conditions, but they differ in degree or intensity. These steps are: (1) Pruning, (2) fertilization, (3) cultivation, and (4) spraying.

A general outline of work or a plan of campaign may be briefly summarized as follows, details being given later on:

(1) If the orchard is and has been in sod for a number of years, plow in the fall about 4 inches deep. If not, plow either in late fall or early spring.

(2) During the winter put on from 12 to 15 loads of barnyard manure per acre, or 1 load to from 3 to 5 trees. Another plan is to apply in the spring 100 to 200 pounds of nitrate of soda, 300 to 500 pounds of acid phosphate, and 150 to 300 pounds of sulphate or muriate of potash.

(3) In the winter or in early spring before growth starts, cut out all dead and diseased wood from the tree, head back the highest limbs, and thin the branches to admit sunlight.

(4) Apply 1,500 to 2,000 pounds of lime per acre and work it and the manure or fertilizer into the soil thoroughly with a disk harrow or spring-tooth harrow. Keep up this cultivation until midsummer.

(5) After cultivation ceases for the season, sow a cover or green-manure crop to plow under the following spring. Winter vetch is one of the best leguminous crops in the North, while cowpeas and to some extent vetch are widely used in middle latitudes and in the South. For a nonleguminous crop rye is the most extensively used, though buckwheat is commonly used in some sections of the North.

(6) Spray the trees in accordance with the directions given in Government and State publications on this subject.

PRUNING.

Pruning is one of the important steps in renovation. It may be done at any time during the dormant season, though it is best done in early spring just before the buds swell or growth starts. Pruning during the dormant season tends to stimulate growth and to make the tree more vigorous. This stimulation is very essential in inducing new vigor into neglected trees.

The operation of pruning has several distinct purposes, all of which should be kept in mind. The first object is to remove all dead, or diseased wood. In doing this work the branch should be cut some distance back from the injured portion and the wound left with smooth edges. In removing large limbs the cut is often made a few inches from the base of the branch and the remaining stub sawed smoothly close to its intersection with the larger limb or trunk. Long stubs left in cutting away large limbs do not heal quickly and they soon die back and produce decay in the main part of the tree. All large wounds should be painted over with some material such as a heavy lead paint or a mixture of one-quarter creosote to three-quarters of coal tar. This treatment excludes moisture and the consequent decay.

The second object in pruning is to shape the tree. Most of the old orchards contain trees that have been set closely together. These trees have been trimmed up and left to grow as they would. Many high headed trees are also due to high heading in the beginning. The object in shaping the trees is to lower the heads so that the operations of pruning, spraying,

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View.

26 and harvesting can be easily performed. In most old or-
 27,28 chards the tops of the trees may be cut back from 5 to 10 feet
 29,30 if good judgment is used in doing the work. The leading
 31 branches are usually headed back, leaving many of the side
 32 branches to be headed back the second or third year. It is
 not usually safe to cut the tree back too severely the first year.

The third object in pruning is to open up the head of the
 tree, so as to admit plenty of sunlight to the leaves and fruit,
 and to avoid excessive competition among the branches.
 33 This object is achieved by thinning out the smaller branches
 and in many cases the larger limbs also. All branches that
 interfere with others are also taken out.

In many of the old orchards the trees were planted very
 close together and it is often desirable to cut out some of the
 trees. Vigorous growing varieties like Baldwin, Northern
 Spy, Rhode Island Greening, Arkansas (Mammoth Black
 Twig), and others, are too close for profit when 30 feet apart
 or less, while varieties like Winesap, Wagener, Wealthy, and
 others, would have sufficient room with a space between
 trees of 30 feet. The trees should be thinned out so as to
 leave plenty of room for the tree to grow and room for the
 operator to spray, and cultivate the trees and harvest the
 fruit. The thinning may be done by cutting out every other
 tree in the row but leaving the trees in one row opposite the
 vacant spaces in the adjoining row.
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The tools required for pruning are a saw, long-handled and
 short-handled pruners, and pruning shears. The saw is the
 best all-around tool for pruning old trees, and an excellent
 type is one about 20 inches long, with a narrow blade not
 easily bent, and with teeth on one side only. Long-handled
 pruners are useful for thinning out small branches and
 heading back the ends of high branches. Short-handled
 pruners with short, heavy blades are useful for cutting limbs
 that are too thick for the hand shears and that can not be
 conveniently cut with the saw. All tools used in pruning
 should be kept sharp so that all cuts may be made as smooth
 as possible.

TOP-WORKING.

In many of the neglected orchards there are some trees
 that are nonproductive or are of undesirable varieties. If
 the trees are vigorous and conditions are favorable these
 trees may be headed back and top-worked. If the work is
 properly done the new top will begin to produce fruit in three
 or four years.
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Top-working is usually done by cleft grafting or by kerf grafting. The best time for doing the work is in the spring when the buds begin to swell. The scion wood used in grafting should be cut from vigorous growing trees of the variety desired, but care should be used not to select water sprouts. The wood selected should be from $\frac{3}{16}$ to $\frac{3}{8}$ of an inch in diameter, or about the size of a lead pencil, and should consist of well-matured wood of the last season's growth. The stubs selected for grafting should be well distributed through the tree, and should not be larger than 2 to $2\frac{1}{2}$ inches in diameter or smaller than $\frac{3}{4}$ of an inch. Many men prefer to distribute the work of grafting over three seasons, grafting one-third of the tree each year. The process of grafting is simple and can be done successfully by anyone after a little practice.

CULTIVATION.

If an old fruit orchard is in sod, especially if the sod is an old or stiff one, it should be plowed in the fall. Ordinarily, fall plowing is good practice in most orchards, but in cases where the soil is very loose and liable to wash and expose the roots to freezing, or where it is very heavy and apt to puddle when exposed to the weather, it is best to plow in spring. By turning under the grass, rubbish, etc., in the fall the process of decay and incorporation with the soil is hastened. A soil often becomes deadened or lifeless from long inertia, and when exposed to the action of moisture and frost its physical condition will be improved. A disk harrow may often be successfully used for the first breaking up of this sod preparatory to plowing.

It is never advisable to plow deeply in old orchards. Plowing should be only deep enough to turn under grass and other litter and cover it with soil. This depth will be from 3 to 5 inches, 4 being a good average and about right. It is always impossible to plow any old orchard which has long been down in sod without breaking a great many of the roots, which, of course, will be close to the surface, but it is desirable to break as few of these roots as possible; hence the necessity for shallow plowing. However, the danger of breaking roots should discourage no one from plowing, as the benefits derived under such conditions are many times greater than the damage done.

After fall plowing a stiff sod, the best tool to use in the early spring to loosen up the surface soil and to work in any manure which may have been applied during the winter is the disk harrow. In very loose and open, deep soils the spring-

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View.

tooth harrow will answer for this purpose, though not as well as the disk, which is the most effective implement, especially where there is a very stiff sod to be broken up or much coarse litter is on the surface. Still it will do very satisfactory work and on stony land is better than the disk harrow. The orchard should be gone over several times with one of these tools during the first month in which it is possible to get on the land, the sooner after growth starts the better.

After the soil has been worked into a fine mechanical condition subsequent cultivation will be done largely in order to maintain a surface mulch to prevent the loss of moisture by evaporation and incidentally to kill and keep down weeds. For this purpose the spring-tooth harrow should be set more shallow or, better still, the spike-tooth or smothering harrow should be used. The orchard should be gone over once in 10 days or two weeks, or after hard rains, which form a crust.

COVER CROPS.

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About the middle of July or the first of August cover crops should be sown. These are of two kinds, leguminous and nonleguminous. Of the former crimson clover, red clover, and hairy vetch for the North and cowpeas and soy beans for the middle and southern latitudes are perhaps the best. Hairy vetch is also sometimes used in the South. Of the nonleguminous cover crops rye is the most widely used, though in some sections, particularly in the North, buckwheat serves the purpose well.

The leguminous crops, besides being of value for the humus which they supply, add nitrogen to the soil. In fact, they form the cheapest source of that element of plant food. In general, they are the most desirable cover crops to use in an old orchard, although their use may possibly be overdone in young orchards. If the cover crop can be sown before the middle of July, red clover or vetch is probably best in the North, while cowpeas hold a relative position in warmer sections.

In seeding, from 12 to 15 pounds per acre of red or crimson clover should be used and sown broadcast, being covered with the smoothing harrow. One bushel of cowpeas or soy beans per acre is a fair rate of seeding for these crops. They are usually sown broadcast.

If it is impossible to sow the cover crop before the middle of July, especially in the North, hairy or winter vetch is better, because it grows later in the season than clover, which in the North will not usually make sufficient growth to pay if

sown after the first of August. About a bushel of vetch seed per acre is required, making the seeding expensive at the prevailing prices of vetch seed.

If nonleguminous crops are to be used, rye is an excellent crop where it is not too much shaded. It may be sown any time between July 15 and November 15. In the warmer sections of the country rye should not be sown too early when wanted as a winter cover crop, otherwise in the long season of growth which follows it will reach too great a degree of maturity. It grows rapidly and quite rank late in the fall and early in the spring and is very hardy. Two bushels of seed are required per acre. Buckwheat is nearly as good and may be sown up to September 1. It does not produce quite as much growth as rye, but grows even more rapidly. A bushel of seed per acre is sufficient. Neither of these crops adds plant food to the soil as do the legumes, nor are their root systems as deep or extensive, but they probably produce more humus-forming material in a short time than clover. When good vigor is established in the apple orchard, leguminous and nonleguminous cover crops may be alternated, or they may be sown together. For the first few years, however, leguminous crops should be used. When sown together, use a little more than half the regular seeding of each. The use of winter crops, of course, necessitates spring plowing.

FERTILIZATION.

Most neglected orchards have been left in sod for many years and are in sod at present. Many are cropped in the regular rotation and the crops removed from the land. In most cases no effort has been made to feed the trees or to keep up the fertility of the soil.

Fruit is as much a crop as anything grown on the farm and should be so regarded. If the trees are not taken care of a farmer has no reason to expect that they will give good yields. When more than one crop is grown on the same land without extra care, fertilization, etc., good yields of both may not justly be expected. When this practice has been in vogue on a farm it may be expected that the orchard will be lacking in fertility. The growth of the trees will usually indicate the fact. If the tree looks scrawny and stunted, and if examination shows either that no growth or but a few inches of annual growth is being made, it is certain that fertilization is one of the necessary requisites for rejuvenation.

The necessary plant food is best supplied by barnyard manure applied at the rate of 10 loads per acre for a light appli-

View.

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cation or 20 loads for heavy application. This amounts to a load for each two to five trees. Such an application will not only go far toward supplying the necessary nitrogen, phosphoric acid, and potash, but especially, of course, will add humus and help to improve the physical condition of the soil. Manure should be applied in the fall after plowing or during the winter, except on land that washes badly. It should not be piled near the trunk of the tree, but should be spread uniformly over the entire surface of the ground. It is particularly essential to spread the manure under and beyond the farthest extent of the branches, as the most important feeding roots penetrate this area.

Nitrogen produces strong wood growth, which is desirable on old trees not growing vigorously. It is easily possible to overdo the use of nitrogen and produce wood growth at the expense of fruit buds and fruit. Potash and phosphoric acid are found in larger proportions in the leaves and fruit. Good, vigorous twig growth and abundance of large dark-green leaves, and fruit of good size are the most satisfactory proof of sufficient fertility.

Manure will usually supply the needed elements in sufficient quantity, if a medium to heavy application can be made. But if it can not be obtained, commercial fertilizers may be resorted to. For the first year about 200 pounds of nitrate of soda or 300 pounds of dried blood per acre should be applied broadcast in early spring and thoroughly worked into the soil with the spring-tooth harrow. It is well to apply the nitrate of soda in two applications a few weeks apart, especially on soils which are leachy and in wet seasons, as part of the nitrogen may leach away if it is all applied at once. It should also be applied a little later than the other fertilizers, after growth has started. After the first year leguminous cover crops should be depended on for nitrogen. Then from 200 to 400 pounds of treated rock phosphate or basic slag and the same amount of sulphate or muriate of potash¹ should be used when they can be secured at normal price to furnish the other two elements. Thus a large amount of available plant food will be supplied to the tree and should result not only in better wood growth, but in the formation of vigorous leaf and fruit buds for the following year.

Lime is not usually a true fertilizer, except on soils markedly deficient in lime. It will usually be advisable to use an initial

¹ Results obtained at the Massachusetts Agricultural Experiment Station and at the Pennsylvania State College Agricultural Experiment Station would indicate that sulphate is better than muriate of potash. See Massachusetts Sta. Rpt. 1910, p. 10; also Pennsylvania Sta. Bul. 100.

application of 1,500 to 2,000 pounds of fresh-burned lime, or its equivalent, per acre, in order to correct natural soil acidity, if there be any, to hasten the decay of organic material, to increase the activity of the soil bacteria, and to improve the physical condition of the soil by flocculating the soil particles and breaking up lumpy soils. Lime also helps to liberate plant food by recombining it with certain other elements. After this first heavy application of lime, an additional 800 pounds may be applied about every four or five years.

SPRAYING.

It is absolutely necessary to spray the old fruit orchard. Pruning, cultivating, and fertilizing are matters of choice but spraying is a necessity. Spraying must be done and done right. The right kind of mixture must be used at the right 46, 47 time and applied in the proper manner. The experiment station officials of your home State or the United States Department of Agriculture should be consulted and data worked out for your local needs. All directions given you should be followed explicitly.

Sprays may be applied with any of several hand pumps well 48 suited for the purpose and costing, with barrel, hose, nozzle, and all necessary attachments, from \$20 to \$50. If the orchard is larger than five or six acres it may pay to purchase a 49 gasoline engine and outfit or a compressed-air outfit, especially where these outfits can also be utilized for other purposes.

PROFITS FROM RENOVATED ORCHARDS.

Table IV gives the accurate record of a 6.1-acre orchard for nine years and will give the reader a good idea of the expense, income, and net profit on an average orchard in western New York for the period: 50

TABLE IV.—*Income, expense, and net profits on a 6.1-acre apple orchard in western New York.*

Year.	Income.		Expense.		Net profit.	
	Total.	Per acre.	Total.	Per acre.	Total.	Per acre.
1902.....	\$913. 87	\$149. 81	\$519. 39	\$85. 15	\$394. 48	\$64. 66
1903.....	969. 89	159. 00	482. 56	79. 11	487. 33	79. 89
1904.....	559. 40	91. 70	360. 39	59. 08	199. 02	32. 62
1905.....	792. 25	129. 87	324. 31	53. 16	467. 94	76. 71
1906.....	818. 76	134. 22	401. 80	65. 87	416. 96	68. 35
1907.....	861. 45	141. 22	364. 40	59. 74	497. 05	81. 48
1908.....	1,362. 97	223. 44	583. 55	95. 67	779. 42	127. 77
1909.....	1,896. 79	310. 95	591. 93	97. 03	1,304. 86	213. 92
1910.....	1,008. 44	165. 32	399. 77	65. 54	608. 67	99. 78
9-year average.....	1,020. 42	167. 28	447. 57	73. 38	572. 85	93. 93

View.

The average yield during the nine years was 67 barrels per acre, which sold for an average price of \$2.33 per barrel. Culls and drops made up the remainder. The average cost of production was \$1.16 per barrel.

The expense included not only the usual items in the cost of production, such as pruning, cultivation, spraying, harvesting, marketing, etc., but land taxes, 5 per cent interest on the investment in equipment and on the land investment at \$150 per acre.

About one-half of the trees are 36 years old. The remainder are over 50 years old. The varieties are principally Baldwin, Twenty Ounce, and Tompkins King. The younger trees are set 32 by 32 feet, the older 28 by 56 feet (one-half having been cut out), and many trees are missing in both blocks. The orchard contains 243 mature trees.

A characteristic example of orchard renovation is the case of a farmer in Monroe County, N. Y. A 4-acre orchard over 50 years old containing about 120 trees, mostly Baldwins (nearly half of the trees had died), had had no care whatever for at least 20 years. The largest income ever obtained from this old orchard in its best year was \$400 and the average income was probably less than \$100.

This farm changed ownership. The new owner was a good orchardist and began operations to renovate the orchard at once. Seventy-five loads of stable manure were applied and plowed under and the most thorough cultivation was practiced. About one-fourth of all the wood in the trees was removed and the trees were thoroughly sprayed.

The first year not more than \$25 worth of fruit was sold, but the second year the response to better methods was \$1,100 worth of fruit. Pruning has cost about \$50, plowing and cultivation \$75, spraying \$60, and fertilization \$100, a total of \$285, leaving a net profit for the first two years of operating of \$840, or \$210 per acre.

APPENDIX.

LANTERN SLIDES.

No. of
view.

1. A typical old orchard which has received little attention during its lifetime.
2. A few old trees that constitute a farm orchard.
3. Fruit trees planted on poor, rocky soil which could not be used for other farm crops.
4. An apple orchard with trees 56 years old.
Note the vigor of growth where the conditions were favorable.
5. An old orchard where the conditions were not as favorable for growth.
6. An orchard in which the trees have been ruined by improper pruning.
Note how all the lower limbs have been cut away, and also the stubs of limbs that have been left.
7. A neglected orchard that has been in sod for 25 years, and the grass pastured down by cattle and horses.
8. These trees have been starved by cropping between the rows.
9. Trees in an old farm orchard, which produce little fruit and this of a very inferior grade.
10. A plan showing how to make an inventory of the orchard.
This plan shows the trees to save and the ones to cut out in renovating.
11. An orchard in which few trees were left after the ones not worth renewing were cut out.
12. An orchard with young trees set in between older trees. The larger trees are not very old, however.
13. Trees too badly diseased to be profitably renewed.
14. An orchard with some trees in the hollow which do not bloom for a week later than the ones on the elevation.
15. A tree so diseased that a large limb has broken down.
So much dead wood must be removed that it is questionable whether the tree that is left is worth the labor expended in renovating.
16. It is questionable whether trees weakened like this can be profitably renewed.
17. The vigor of these trees has been seriously reduced by the ravages of insects and plant diseases, and also by cropping the land between the trees.
The trees are young and by proper spraying, fertilizing, and pruning the orchard might be made profitable.
18. A table showing the average yield of apples in some of the old orchards of western New York.
From orchard surveys made by Cornell University Experiment Sta. Bul. 226, 229, 262.
19. A table showing the average yield of apples per tree in counties of western New York.
From Cornell University Experiment Station Bul. 226, 229, and 262.
20. A table showing the cost of the first year's work in renovating an old orchard.
21. A tree showing where to cut when taking off a large limb.
The outer mark is the first cut and the mark next to the main trunk is the second cut.
22. The wound made in taking off a large limb in the proper manner.
Note how quickly it begins to heal over.
23. The trunk of a young apple tree showing how quickly the wounds heal when the limbs are taken off close to the main trunk or limb.
Also note the stub which is already beginning to decay.
24. Decay resulting from the leaving of stubs in cutting away large limbs.

No. of
view.

25. Trees planted close together with the result that there are long limbs in the top of the tree which break over when loaded with fruit.
26. High-headed trees make spraying difficult.
27. High-headed trees before deheading.

The white marks show where the branches should be cut.

28. The same orchard after the trees have been deheaded and the brush cleared out and burned.

Note that many of the large limbs have not been cut back near a large side branch as they should be.

29. Trees in blossom the second spring after deheading.
30. Trees several years after deheading.

Note the low stocky heads.

31. Trees which were to be headed back severely so only part of the limbs were cut back the first year.
32. A low-headed tree, but one in which the center is filled up with intercrossing branches.
33. A well-pruned tree.

Note where many of the top branches have been cut out to keep the center of the top open.

34. A plan showing which trees to cut out when thinning a closely-planted orchard.
35. A large apple tree before top-working.
36. The same tree after the grafting has been done.
37. The second year's growth after top-working.

Note the vigorous growth and also need for thinning out the branches.

38. An old orchard in which the sod has been plowed under in the fall.
39. The disk is a very useful tool in cutting up the old sod in an orchard in preparation for turning under.
40. Breaking up the sod in an old orchard.

Note the comparatively shallow furrow even when plowing some distance from the trees.

41. An orchard in which the soil immediately around the tree has been left undisturbed, but the land between the tree rows has been broken up and cultivated.
42. Another orchard, in which this practice has been reversed.

The first method is the better of the two but no doubt clean tillage around the trees as well as between the rows is the best method.

43. Cowpeas used as a cover crop in the orchard.
44. Trees showing very little annual growth of twigs.
45. An illustration showing the spread of roots and the need for distributing the fertilizer between the rows and not close around the tree trunk.
46. The crop of apples from an unsprayed tree.
47. Crop of apples from a sprayed tree.
48. A very serviceable spraying outfit for a few trees about the farmhouse.
49. A good spraying apparatus for use in larger orchards.
50. A renovated orchard.

The trees have been headed back, a good cover crop has been established, and the trees carry a good crop of fruit.

REFERENCES.

1. Renewal of Old Orchards. Ohio Station Bul. 180.
2. Rejuvenation of Old Orchards. Ohio Sta. Bul. 224.
3. Orchard Rejuvenation in Southeastern Ohio. Ohio Sta. Bul. 301.
4. Apple Orchard Survey of Niagara County. New York (Cornell) Sta. Bul. 262.
5. Apple Orchard Survey of Orleans County. New York (Cornell) Sta. Bul. 229.
6. Apple Orchard Survey of Ontario County. New York (Cornell) Sta. Bul. 307.